

High efficiency ultrafast diode

Features

- Suited for SMPS
- Low losses
- Low forward and reverse recovery times
- Low leakage current
- High junction temperature
- Insulated package: TO-220FPAB

Description

Dual center tap rectifier suited for switch mode power supplies and high frequency DC to DC converters.

Packaged in TO-220AB, D²PAK, TO-220FPAB and I²PAK, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection applications.

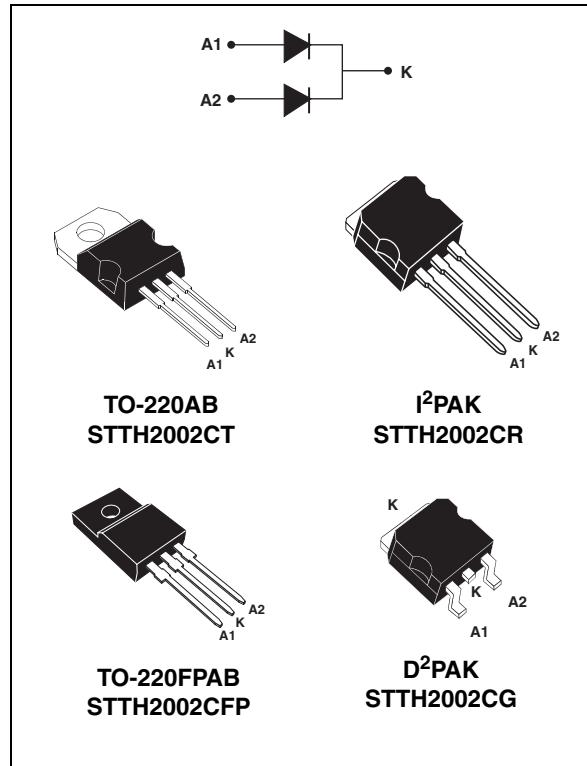


Table 1. Device summary

| Symbol | Value |
|----------------|----------------|
| $I_{F(AV)}$ | Up to 2 x 10 A |
| V_{RRM} | 200 V |
| T_j (max) | 175 °C |
| V_F (typ) | 0.78 V |
| t_{rr} (typ) | 22 ns |

1 Characteristics

Table 2. Absolute ratings (limiting values, per diode)

| Symbol | Parameter | | | Value | Unit | |
|----------------------|--|--|-----------------------------------|--------------|------|---|
| V _{RRM} | Repetitive peak reverse voltage | | | 200 | V | |
| I _{F(RMS)} | Forward rms current | | | 30 | A | |
| I _{F(peak)} | Avarage forward current $\delta = 0.5$ | I ² PAK, D ² PAK, TO-220AB | T _c = 150 °C | Per diode | 10 | A |
| | | | T _c = 140 °C | Per device | 20 | A |
| | | | T _c = 130 °C | Per diode | 15 | A |
| | | | T _c = 115 °C | Per device | 30 | A |
| | | TO-220FPAB | T _c = 120 °C | Per diode | 10 | A |
| | | | T _c = 85 °C | Per device | 20 | A |
| I _{FSM} | Surge non repetitive forward current | | t _p = 10 ms sinusoidal | 90 | A | |
| T _{stg} | Storage temperature range | | | -65 to + 175 | °C | |
| T _j | Maximum operating junction temperature | | | 175 | °C | |

Table 3. Thermal parameters

| Symbol | Parameter | | | Value (max) | Unit |
|----------------------|------------------|--|------------|-------------|------|
| R _{th(j-c)} | Junction to case | I ² PAK, D ² PAK, TO-220AB | Per diode | 2.5 | °C/W |
| | | | Per device | 1.6 | |
| | | TO-220FPAB | Per diode | 5 | |
| | | | Per device | 3.8 | |
| R _{th(c)} | Coupling | I ² PAK, D ² PAK, TO-220AB | | 0.7 | |
| | | TO-220FPAB | | 2.5 | |

When the diodes 1 and 2 are used simultaneously:

$$\Delta T_j \text{ (diode1)} = P_{\text{(diode1)}} \times R_{\text{th(j-c)}} \text{ (per diode)} + P_{\text{(diode2)}} \times R_{\text{th(c)}}$$

Table 4. Static electrical characteristics (per diode)

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|-------------|-------------------------|---------------------------|----------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ\text{C}$ | $V_R = V_{RRM}$ | | | 10 | μA |
| | | $T_j = 125^\circ\text{C}$ | | | 6 | 100 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25^\circ\text{C}$ | $I_F = 10 \text{ A}$ | | | 1.1 | V |
| | | $T_j = 25^\circ\text{C}$ | $I_F = 20 \text{ A}$ | | | 1.25 | |
| | | $T_j = 150^\circ\text{C}$ | $I_F = 10 \text{ A}$ | | 0.78 | 0.89 | |
| | | $T_j = 150^\circ\text{C}$ | $I_F = 20 \text{ A}$ | | | 1.05 | |

1. Pulse test: $t_p = 5 \text{ ms}$, $\delta < 2 \%$ 2. Pulse test: $t_p = 380 \text{ }\mu\text{s}$, $\delta < 2 \%$

To evaluate the conduction losses use the following equation:

$$P = 0.73 \times I_{F(AV)} + 0.020 I_F^2(\text{RMS})$$

Table 5. Dynamic electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|----------|--------------------------|---------------------------|--|------|------|------|------------|
| t_{rr} | Reverse recovery time | $T_j = 25^\circ\text{C}$ | $I_F = 1 \text{ A}$, $V_R = 30 \text{ V}$ $dI_F/dt = 100 \text{ A}/\mu\text{s}$ | | 22 | 27 | ns |
| t_{fr} | Forward recovery time | $T_j = 25^\circ\text{C}$ | $I_F = 10 \text{ A}$, $dI_F/dt = 100 \text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{F\text{max}}$ | | | 200 | ns |
| V_{FP} | Forward recovery voltage | $T_j = 25^\circ\text{C}$ | $I_F = 10 \text{ A}$, $dI_F/dt = 100 \text{ A}/\mu\text{s}$ | | 2.4 | | V |
| I_{RM} | Reverse recovery current | $T_j = 125^\circ\text{C}$ | $I_F = 10 \text{ A}$, $V_R = 160 \text{ V}$ $dI_F/dt = 200 \text{ A}/\mu\text{s}$ | | 7.0 | 9.0 | A |

Figure 1. Peak current versus duty cycle (per diode)

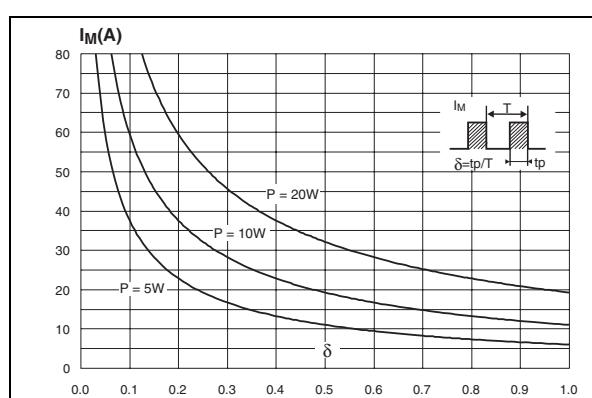


Figure 3. Forward voltage drop versus forward current (maximum values, per diode)

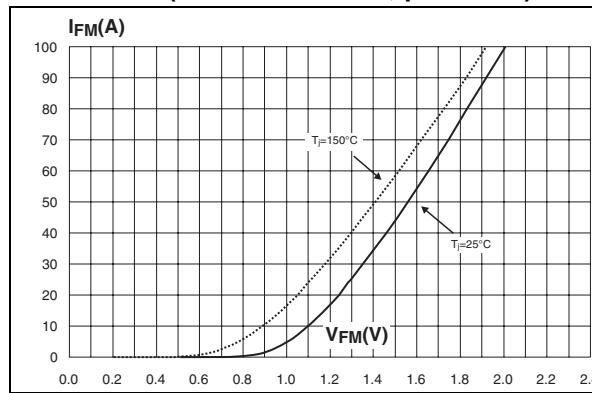


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAB)

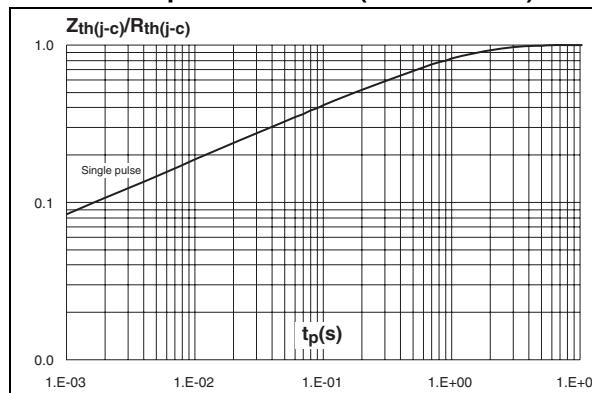


Figure 2. Forward voltage drop versus forward current (typical values, per diode)

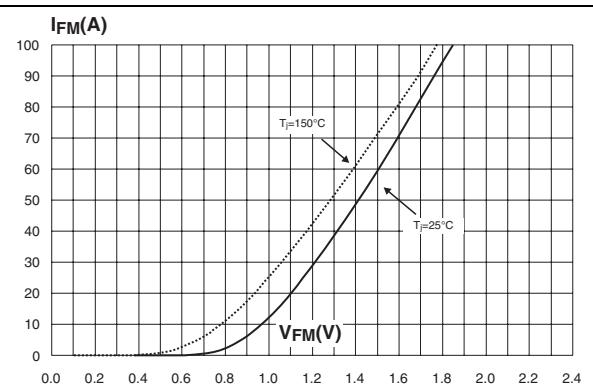


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

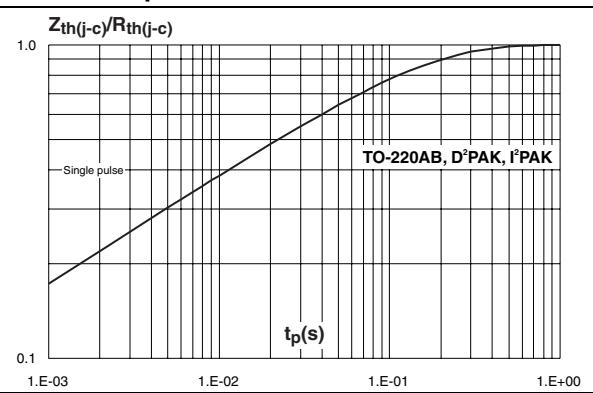


Figure 6. Junction capacitance versus reverse voltage applied (typical values, per diode)

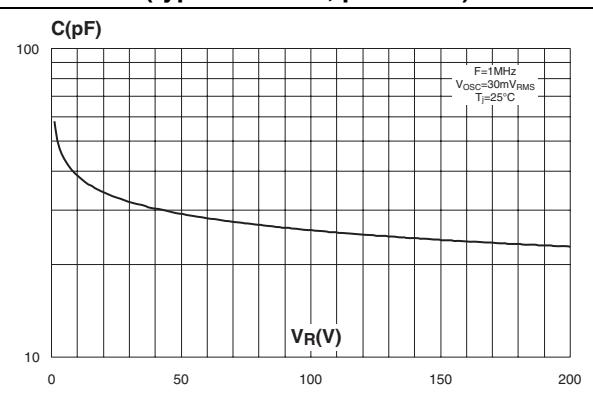


Figure 7. Reverse recovery charges versus di_F/dt (typical values, per diode)

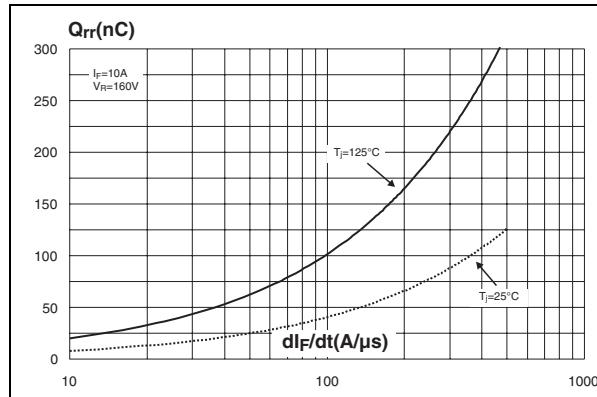


Figure 8. Reverse recovery time versus di_F/dt (typical values, per diode)

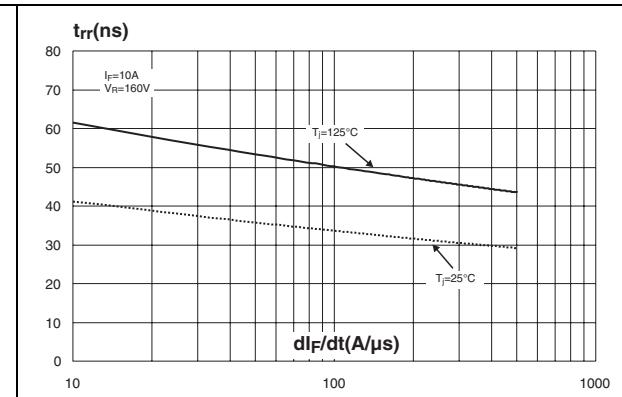


Figure 9. Peak reverse recovery current versus di_F/dt (typical values, per diode)

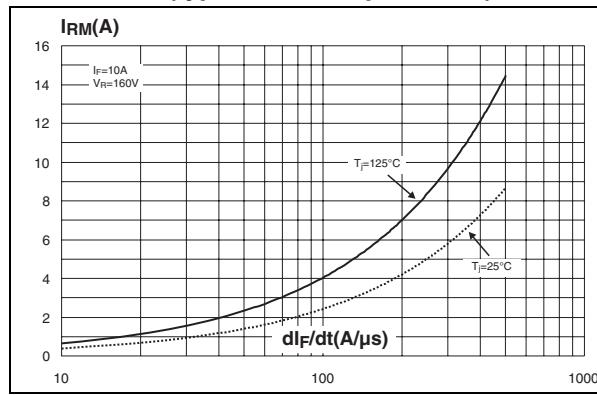


Figure 10. Dynamic parameters versus junction temperature

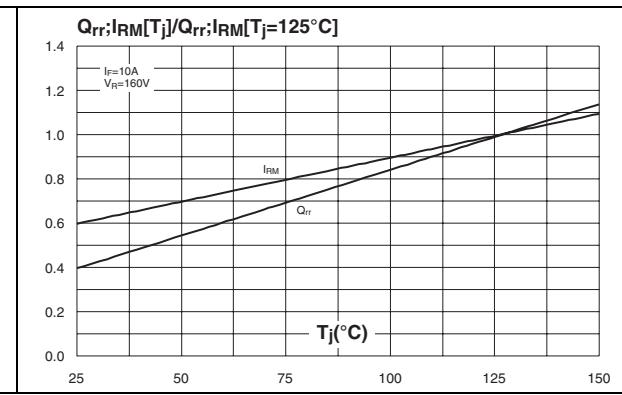
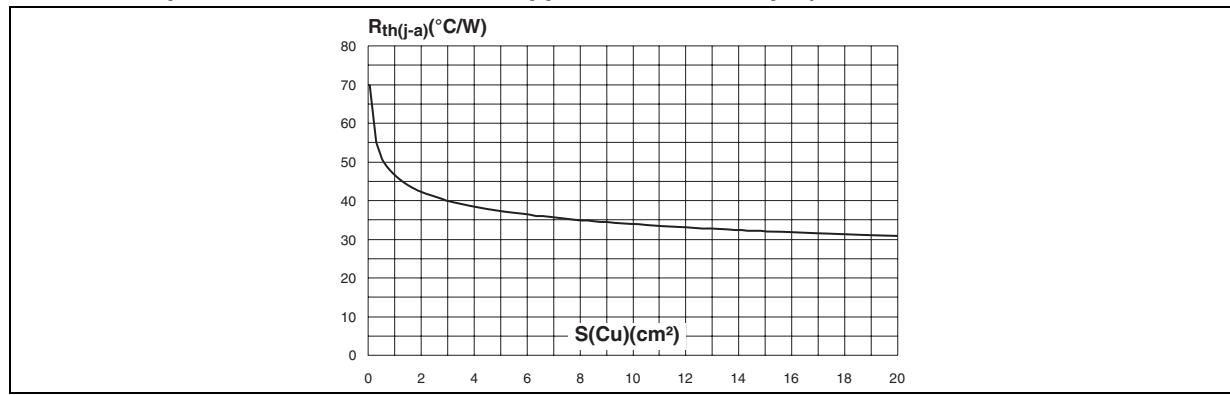


Figure 11. Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4, copper thickness: 35 μm) for D²PAK



2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value : 0.4 to 0.6 N·n

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com.
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Table 6. I²PAK dimensions

| Ref. | Dimensions | | | |
|------|-------------|-------|--------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| A1 | 2.40 | 2.72 | 0.094 | 0.107 |
| b | 0.61 | 0.88 | 0.024 | 0.035 |
| b1 | 1.14 | 1.70 | 0.044 | 0.067 |
| c | 0.49 | 0.70 | 0.019 | 0.028 |
| c2 | 1.23 | 1.32 | 0.048 | 0.052 |
| D | 8.95 | 9.35 | 0.352 | 0.368 |
| e | 2.40 | 2.70 | 0.094 | 0.106 |
| e1 | 4.95 | 5.15 | 0.195 | 0.203 |
| E | 10 | 10.40 | 0.394 | 0.409 |
| L | 13 | 14 | 0.512 | 0.551 |
| L1 | 3.50 | 3.93 | 0.138 | 0.155 |
| L2 | 1.27 | 1.40 | 0.050 | 0.055 |

Table 7. D²PAK dimensions

| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.30 | | 4.60 | 0.169 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.70 | | 0.93 | 0.027 | | 0.037 |
| B2 | 1.25 | 1.40 | | 0.048 | 0.055 | |
| C | 0.45 | | 0.60 | 0.017 | | 0.024 |
| C2 | 1.21 | | 1.36 | 0.047 | | 0.054 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| E | 10.00 | | 10.28 | 0.393 | | 0.405 |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15.00 | | 15.85 | 0.590 | | 0.624 |
| L2 | 1.27 | | 1.40 | 0.050 | | 0.055 |
| L3 | 1.40 | | 1.75 | 0.055 | | 0.069 |
| R | 0.40 | | | 0.016 | | |
| V2 | 0° | | 8° | 0° | | 8° |

Figure 12. Footprint (dimensions in mm)

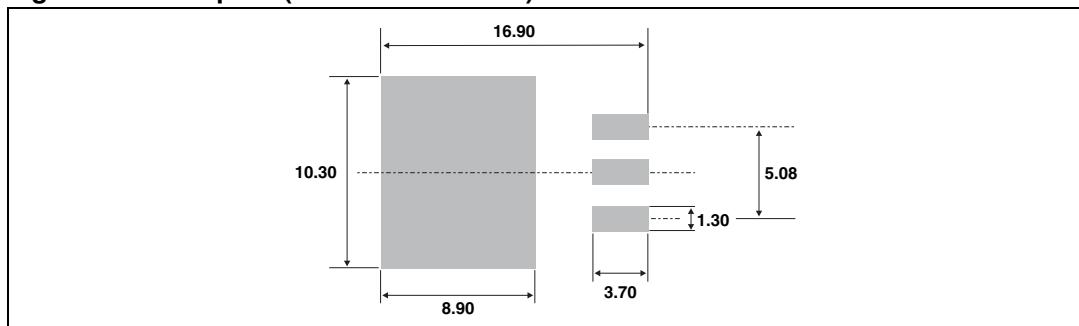


Table 8. TO-220AB dimensions

| Ref. | Dimensions | | | |
|-------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| C | 1.23 | 1.32 | 0.048 | 0.051 |
| D | 2.40 | 2.72 | 0.094 | 0.107 |
| E | 0.49 | 0.70 | 0.019 | 0.027 |
| F | 0.61 | 0.88 | 0.024 | 0.034 |
| F1 | 1.14 | 1.70 | 0.044 | 0.066 |
| F2 | 1.14 | 1.70 | 0.044 | 0.066 |
| G | 4.95 | 5.15 | 0.194 | 0.202 |
| G1 | 2.40 | 2.70 | 0.094 | 0.106 |
| H2 | 10 | 10.40 | 0.393 | 0.409 |
| L2 | 16.4 typ. | | 0.645 typ. | |
| L4 | 13 | 14 | 0.511 | 0.551 |
| L5 | 2.65 | 2.95 | 0.104 | 0.116 |
| L6 | 15.25 | 15.75 | 0.600 | 0.620 |
| L7 | 6.20 | 6.60 | 0.244 | 0.259 |
| L9 | 3.50 | 3.93 | 0.137 | 0.154 |
| M | 2.6 typ. | | 0.102 typ. | |
| Diam. | 3.75 | 3.85 | 0.147 | 0.151 |

Table 9. TO-220FPAB dimensions

| Ref. | Dimensions | | | |
|------|-------------|------|-----------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.4 | 4.6 | 0.173 | 0.181 |
| B | 2.5 | 2.7 | 0.098 | 0.106 |
| D | 2.5 | 2.75 | 0.098 | 0.108 |
| E | 0.45 | 0.70 | 0.018 | 0.027 |
| F | 0.75 | 1 | 0.030 | 0.039 |
| F1 | 1.15 | 1.5 | 0.045 | 0.059 |
| F2 | 1.15 | 1.5 | 0.045 | 0.059 |
| G | 4.95 | 5.20 | 0.195 | 0.205 |
| G1 | 2.4 | 2.7 | 0.094 | 0.106 |
| H | 10 | 10.4 | 0.393 | 0.409 |
| L2 | 16 Typ. | | 0.63 Typ. | |
| L3 | 28.6 | 30.6 | 1.126 | 1.205 |
| L4 | 9.8 | 10.6 | 0.386 | 0.417 |
| L5 | 2.9 | 3.6 | 0.114 | 0.142 |
| L6 | 15.9 | 16.4 | 0.626 | 0.646 |
| L7 | 9.00 | 9.30 | 0.354 | 0.366 |
| Dia. | 3.00 | 3.20 | 0.118 | 0.126 |

3 Ordering information

Table 10. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|---------------|-------------|--------------------|--------|----------|---------------|
| STTH2002CT | STTH2002CT | TO-220AB | 2.23 g | 50 | Tube |
| STTH2002CG | STTH2002CG | D ² PAK | 1.48 g | 50 | Tube |
| STTH2002CG-TR | STTH2002CG | D ² PAK | 1.48 g | 1000 | Tape and reel |
| STTH2002CR | STTH2002CR | I ² PAK | 1.49 g | 50 | Tube |
| STTH2002CFP | STTH2002CFP | TO-220AB | 1.70 g | 50 | Tube |

4 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| Feb-2004 | 1 | First issue. |
| 23-Jun-2010 | 2 | Updated Table 1 . Updated ECOPACK statement. |

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